



2004 NSTAR Transmission and Distribution Major Project Summary

April 27, 2004

**Prepared By:
System Planning
Engineering**

Introduction

The reliability of NSTAR's transmission and distribution system relies upon a determination whether the systems have the ability to adequately serve customer load during normal and contingency outage conditions. The 2004 NSTAR operating study evaluated the performance of the NSTAR system for the projected 2004 summer peak load conditions. The results of the Operating Study indicate the performance of the NSTAR transmission and distribution system is good for both all-lines-in and post-contingency basis. Though generally the system performance meets or exceeds the NSTAR reliability criteria, there are several supply regions that will need system upgrades and infrastructure developments to continue fulfill the customer supply requirements. During 2004 NSTAR will initiate the following major project to mitigate potential concerns:

- New Colburn Street Substation #350, Mission Hill, Boston
- East Cambridge Substation #875, Cambridge

This report provides a description of the project, the need, and the alternatives considered to resolve the identified concern for this major project.

New Colburn Street Substation #350 – Mission Hill, Boston

Project Description & Objectives (Including Strategic Fit):

The proposed project consists of building a new 115/14 kV substation at Colburn Street, on NSTAR land at the intersection of Huntington and South Huntington Avenues in Roxbury. The substation and associated distribution infrastructure will be built to coincide with the increased load growth and to improve the reliability of service to customers in the Town of Brookline, and the City of Boston neighborhoods of Brighton, Dorchester, Jamaica Plain, Mission Hill, Longwood Medical Area, Roxbury and Kenmore-Fenway. The initial firm capacity of the new Colburn Street station will be 150 MVA (In Service date June 1, 2004) through the installation of three 115/14 kV 62.5 MVA transformers with an initial load of 75 MVA. The station will be designed to accommodate a fourth transformer, thereby allowing the station to be expanded to an ultimate 225 MVA firm capacity. The development of the new Colburn Street 115/14kV substation will provide capacity to relieve five heavily loaded bulk supply stations: Andrew Square Station 106, Brighton Station 329, Dewar Street Station 483, Scotia Street Station 492 and Hyde Park Station 496. In addition to relieving the area stations, Colburn Street will establish 20 MVA of transfer capability out of four of the bulk supply stations: Stations 106, 329, 483 and 496, increasing the load carry capability at the each of the stations. The new Colburn Street 115/14kV substation will improve the reliability to the area. The added distribution capacity will reduce the load on thermally constrained distribution systems at Brighton Station 329 and Hyde Park Station 496, relieve existing distribution lines, support 4kV conversions and allow for the retirement of the 24kV supply out of Brighton Station.

Scope:

Critical long lead-time equipment and materials

- 115 kV Transmission Cable - 4 months for delivery
- 115/14kV 62.5 MVA transformers - 6 months for delivery
- 15kV Switchgear - 6 – 8 months for delivery

Transmission work

Install 4 - 115kV transmission pipes from Huntington Avenue onto the Colburn Street property. This work will be coordinated with distribution conduit to minimize conflicts with the City of Boston's on street work and the Democratic National Convention roadwork restrictions that will be in place in 2004.

Distribution Substation work - 115/14kV Substation

Develop a new outdoor 115/14 kV substation on NSTAR land at Colburn Street located at the intersection of South Huntington and Huntington Avenue. The firm capacity of the station will be 150 MVA. The station will be developed to accommodate a 4th transformer and a 225 MVA Firm Capacity.

Colburn Street Substation details

150 MVA Firm Capacity

The new Colburn Street 115/14kV station will consist of:

- Three (3) - 37/50/62.5 MVA LTC Transformers
- One (1) AIS 115kV Breaker

- Six Distribution Metal Clad Switchgear Sections – Thirty-six (36) - DSS/Distribution Feeders.
- Two (2) -14.4 kV 9.6 Mvar Station capacitor banks
- Scada RTU

Distribution work for Spring, Summer and Fall, 2004

- Install getaway conduit on Colburn Street
- Install new distribution conduit on Huntington and South Huntington Avenues to interconnect into the existing conduit in the area.

Install 15 new lines to cutover load from Andrew Sq., Brighton, Dewar Street and Hyde Park stations.

- **Andrew Square Station relief:** Cutover of the VA Hospital Station 304 and NE Baptist Hospital Station 570 and Brookline Village/Medical area distribution circuit 106-H4 - 11 MVA of relief
- **Brighton Station relief:** Cutover of portions of 493-136H, 493-175H, 426-169H, 329-1N172H and Station 396 a 24kV to 4kV Station in Jackson Square. Station 396 will be re-supplied via two new 14kV supply lines - 35 MVA of relief
- **Dewar Street Station relief:** Cutover of 52-1487H, 52-1494H, 52-1499H, and Fenway area distribution 483-H6 - 22 MVA of relief
- **Hyde Park Station relief:** Cutover of circuit 496-H4 - 7.5 MVA of relief

Distribution work planned for December 31, 2004

Install 7 new lines to cutover load from Andrew Square, Brighton, and Hyde Park stations.

- **Andrew Square Station relief:** Cutover of Northeastern Station 452 - 5.5 MVA of relief
- **Brighton relief:** Cutover of portion of 329-H3 - 2 MVA of relief
- **Hyde Park Station relief:** Cutover of Station 284 in Jamaica Plain - 13 MVA of relief

Work planned for 2005:

Distribution work required by May 15, 2005

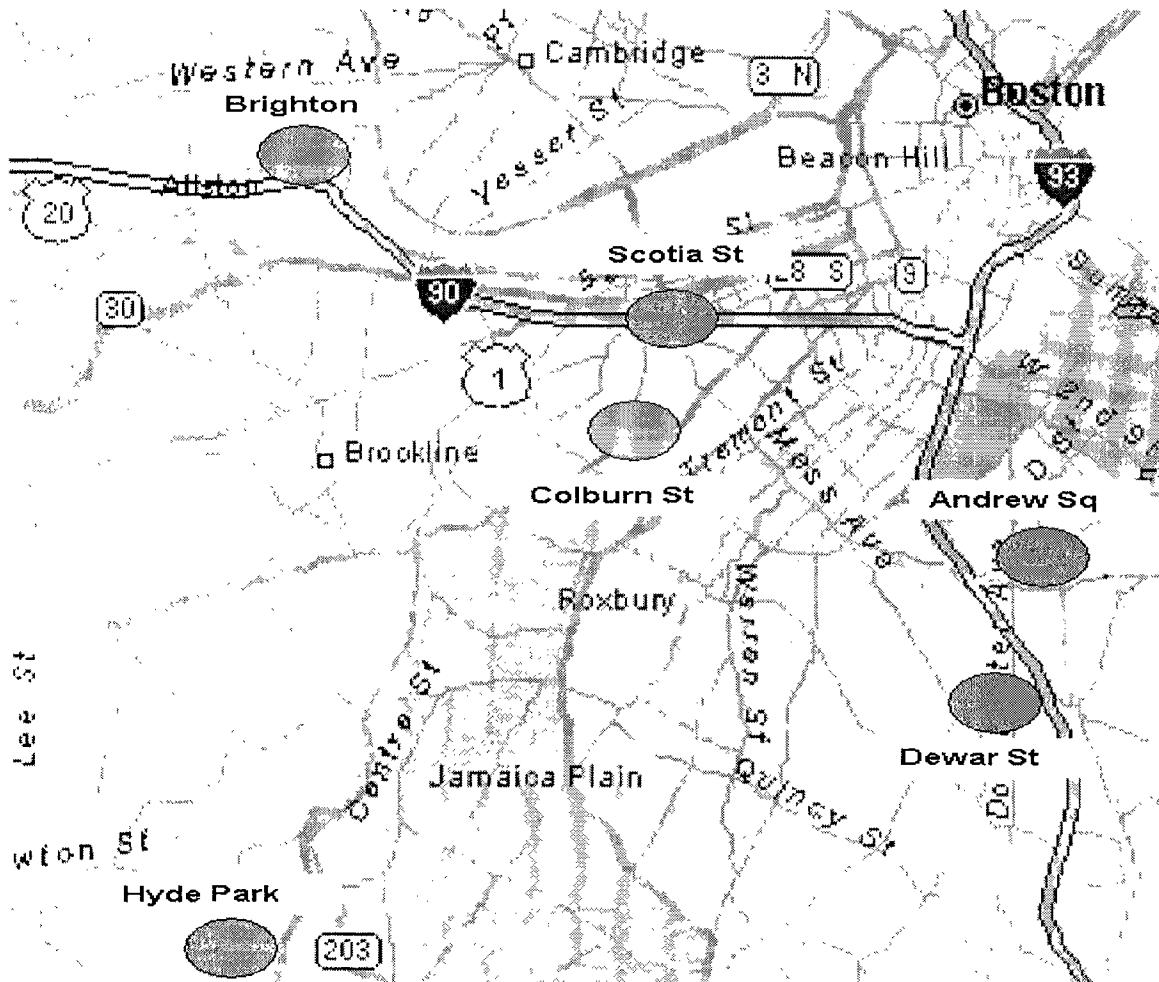
Install 7 new lines to cutover load from Brighton, and Scotia Street stations and relief of lines out of Dewar Street and Andrew Square.

- **Brighton relief:** Cutover of portions of 506-138H, 506-140H, and 506-173H - 16 MVA of relief
- **Scotia Street Station relief:** Cutover of Station 49 in Kenmore Square and Northeastern University Station 573 - 23 MVA of relief

The new distribution infrastructure will be developed with adequate conduit to allow incremental expansion to coincide with the region's future load requirements.

Justification:

Five bulk supply stations: Andrew Square Station 106, Brighton Station 329, Dewar Street Station 483, Scotia Street Station 492 and Hyde Park Station 496 supply the following neighborhoods: Brookline Village, Longwood Medical Area, Mission Hill, Roxbury Crossing, Jamaica Plain, and Kenmore-Fenway within the proposed Colburn Street area. This region continues to experience significant load growth.

Boston Radial Supply Stations**Brighton Station #329**

During the summer of 2002, the Brighton Station 329 peak load was 199 MVA. The station consists of two 115/14 kV transformers, one 115/24/14kV (unique to Brighton) and one 14/24kV transformer. The station has a firm capacity of 217 MVA. The Brighton Station 329 facilities and infrastructure have inherent reliability concerns, which could be an issue with respect to the performance of the region's power supply. One of the primary concerns at Brighton Station is the distribution infrastructures thermal constraint. In August 2001, the Brighton supply suffered a significant outage event when 14 of the station's 32 feeders faulted over a 15-hour period.

The cause of this event was attributed to thermal overload of the distribution cables exiting the station.

The thermal analysis of the Brighton Station distribution cable getaways has identified that the existing distribution infrastructure limits the capability of the station to 217 MVA. This limit is due to a thermal constraint in the duct banks on Harvard Avenue, Allston. Due to the distribution limitation, Brighton Station's revised firm capacity and the load carrying capability are 217 MVA. One of the emerging reliability concerns in the Roxbury area is the 24kV supply out of Station 329 to NSTAR 4kV Station 396 in Jackson Square. There is a concern both at Station 329 and on the supply lines to Jackson Square Station 396. The 24kV supply at Station 329 was modified in 2002 due to the loss of transformer 110A on April 25th this was an 115/24/14kV transformer. Transformer 110A was replaced with two transformers, an 115/14kV transformer and a 14/24kV transformer. On June 29, 2003, the two 24kV supply lines from Brighton Station 329 to Jackson Square Station 396 faulted within 2 1/2 hours of one another. The outage resulted in 7,100 customers in Mission Hill, Jamaica Plain and Brookline without service for several hours some customers were without power for over 10 hours.

There is 17 MVA of available transfer switching to adjacent substations but due to the thermal limits of the distribution system at Station 329 the transfer capability is not applicable in the calculation of the stations load carrying capability. Therefore, Brighton's load carrying capability (i.e. firm capacity + transfer switching) is the same as its firm 217 MVA.

Andrew Square Station 106

During the summer of 2002, Andrew Square Station 106 peak load was 142 MVA. Andrew Square Station 106 consists of five 115/14 kV transformers. The station has a firm capacity of 160 MVA. There is no transfer switching to adjacent substations. Due to a transmission constraint on 483-524/525 Andrew Square's load carrying capability is limited to 130 MVA. The new K Street Distribution Station will provide 25 MVA of load relief for Andrew Square Station 106.

Dewar Street Station 483

During the summer of 2002, Dewar Street Station peak load was 135 MVA. Dewar Street consists of two 115/14 kV transformers. The station has a firm capacity of 150 MVA. There is no transfer switching to adjacent substations. Due to a transmission constraint on 483-524/525, Dewar Street's load carrying capability is limited to 135 MVA.

Scotia Street Station 492

During the summer of 2002, Scotia Street Station peak load was 142 MVA. Scotia Street consists of two 115/14 kV transformers. There is no transfer switching to adjacent substations. The station's load carrying capability is 150 MVA.

Hyde Park Station 496

During the summer of 2002, Hyde Park Station peak load was 155 MVA. Hyde Park consists of two 115/14 kV transformers. The station has a firm capacity of 150 MVA. There is 11 MVA of available transfer capacity to adjacent substations. Hyde Park's load carry capability is 161 MVA.

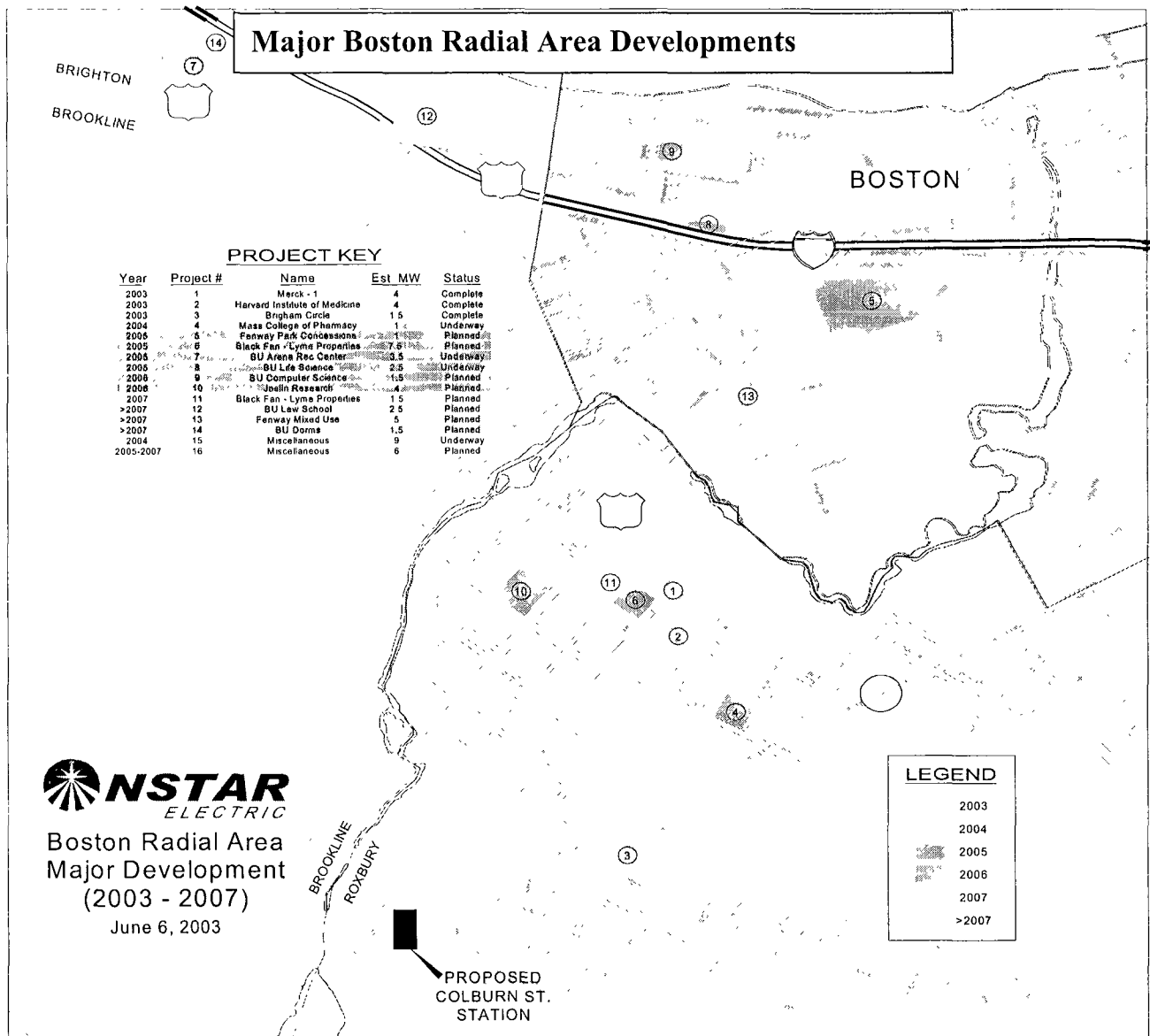
Distribution Supply Constraints and Reliability Concerns

The five stations that supply the Colburn Street area have numerous emerging distribution capacity issues beginning in 2004. The strain on the existing distribution infrastructure is driven by the continued development in the Longwood Medical Area, Fenway-Kenmore Area (Boston University) and Boston Medical Center (Massachusetts Avenue at the Expressway). Twelve distribution circuits will be over their normal limits in 2004 and ten DSS line groups will exceed their emergency limits during N-1 conditions, loss of one line in the line group. The existing

distribution infrastructure is substantially constrained in its ability to supply the proposed major new customer developments. Only Andrew Square Station 106 has any spare feeder positions to support the installation of new DSS lines or distribution circuits.

Substation Capacity Needs – Colburn Street region within the Boston Radial Area

The Colburn Street region continues to experience load growth. Much of the load growth is driven by the region's proximity to the Longwood Medical Area and Boston University, and the ongoing redevelopment of portions of Roxbury. Major new developments continue to stress the distribution and substation capacity in this region. Major developments are planned for Kenmore-Fenway (Boston University), the Longwood Medical Area in Roxbury (various Biotech projects) and the Boston Medical Center in Roxbury (Cross Town project). These ongoing developments throughout the area will substantially increase the load within the Colburn Street service area. The projected new load will be 20 MVA by 2004 with an additional 36 MVA by 2008. This new load will strain the capability of the five stations. The areas existing distribution infrastructure is not capable of supporting the customer load requirements. New substation capacity and distribution infrastructure will be required to support the load growth in and around the Colburn Street area.



The following tables show the 10-year load projections for each of the five substations that supply the Colburn Street area on the probable load additions and the projected deficiency between load and supply.

Brighton Station #329 -- Load (MVA):

Year →	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Brighton Station 329	199	209	218	232	248	258	265	268	272	275	278
LCC*	217	217	217	217	217	217	217	217	217	217	217
Load at Risk			(1)	(15)	(31)	(41)	(48)	(51)	(55)	(58)	(61)

LCC: Load carrying capability (i.e. firm capacity + transfer switching)

* Brighton Station load carry capability is limited by a thermal constraint in the existing distribution infrastructure.

Andrew Square Station #106 -- Load (MVA):

Year →	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Andrew Sq. Station 106	142	126	134	135	136	139	141	144	147	149	152
LCC*	130	130	130	130	130	130	130	130	130	130	130
Load at Risk			(4)	(5)	(6)	(9)	(11)	(14)	(17)	(19)	(22)

Note: Andrew Square was relieved by the New K Street Station in 2003.

* Andrew Sq & Dewar Street Limited to 265 MVA combined due to transmission (N-1) limitation on 483-524/525. Due to this transmission constraint Andrew Square's is limited to 130 MVA.

Dewar Street Station #483 -- Load (MVA):

Year →	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Dewar St Station 483	135	137	138	140	141	143	145	147	149	152	154
LCC*	135	135	135	135	135	135	135	135	135	135	135
Load at Risk			(3)	(5)	(6)	(8)	(10)	(12)	(14)	(17)	(19)

* Due to a transmission constraint on 483-524/525 Dewar Street's LCC is limited to 135 MVA.

Scotia Street Station #492 -- Load (MVA):

Year →	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Scotia St Station 492	142	146	151	152	153	156	159	161	164	166	169
LCC	150	150	150	150	150	150	150	150	150	150	150
Load at Risk			(1)	(2)	(3)	(6)	(9)	(11)	(14)	(16)	(19)

Hyde Park Station #496 -- Load (MVA):

Year →	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Hyde Park Station 496	155	161	167	172	176	179	181	184	186	189	192
LCC**	161	161	161	161	161	161	161	161	161	161	161
Load at Risk			(6)	(11)	(15)	(18)	(20)	(23)	(25)	(28)	(31)

**** Baker St – Brighton Transmission limited to 400 MVA (N-1) limitation 110-510/511 limits Hyde Park's LCC to 161 MVA**

Should all of the known Boston Radial area projects occur, there is the potential for 85 MW of new load by 2008 in addition to the 56 MW of probable load. Much of the new load in the area is within 5000 feet of NSTAR's Colburn Street property. By the Summer 2004 all the stations within the region are projected to exceed their load carrying capabilities.

Colburn Street Impact on Distribution and Substation Needs

The development of a new 115/14kV substation at Colburn Street in Roxbury will provide 150 MVA of necessary substation and distribution capacity to address the needs of the area. The new distribution infrastructure will directly address the distribution issues within the Brighton, Andrew Square, Dewar Street, Scotia Street and Hyde Park supply regions. In addition to providing much needed station capacity, the new Colburn Street Station provides 5 MVA of new distribution transfer capability out of each of the following stations: Andrew Square, Brighton, Dewar Street and Hyde Park. The added transfer capability will allow for higher station capacity utilization. The initial load carrying capability of Colburn Street will be 170 MVA (150 MVA firm capacity plus 20 MVA of transfer capability). The development of transfer capability at Andrew Square, Dewar Street and Hyde Park will ease the transmission restriction on each station's load carry capability. The new distribution circuit ties will allow for transfer of load off the restricted transmission lines during an N-1 condition. The new station will provide 29 new 14 kV distribution lines to the area to relieve existing lines. Two of the new lines will be used to re-supply NSTAR Station 396, a 24kV to 4kV station in Jackson Square, this will allow for the retirement of 24kV supply out Brighton Station 329 and provide 14kV supply to the area for 4kV conversions. The new distribution lines will relieve the thermally constrained getaways of Brighton Station 329 and Hyde Park Station 496. The new infrastructure will provide 14kV capacity to support the proposed major customer developments and the incremental load growth in the Boston Radial area. The new Colburn Street station will also provide new sources for 4kV conversions to improve reliability and capacity in Brookline, Jamaica Plain, and Roxbury. The injection of new distribution into the area will release 6 breaker positions at Brighton, 3 breaker positions at Andrew Square, 4 breaker positions at Dewar Street, 4 breaker positions at Scotia Street and 1 breaker position at Hyde Park to support installation of future lines and circuits. When fully loaded to 225 MVA the new Colburn Street station will have a capacity utilization of 90%.

The new Colburn Street Station will relieve five substations:

- Andrew Square Station 106 16.5 MVA
- Brighton Station 329 53 MVA
- Dewar Street Station 483 22 MVA
- Scotia Street Station 492 23 MVA
- Hyde Park Station 496 20.5 MVA

The station development eliminates the need for distribution infrastructure within the Brighton Station area. Without the new Colburn station this infrastructure would be necessary to supply new customer developments and meet the incremental load growth in the Brighton service area. The investment does not defer the need for Colburn Street station and the new infrastructure would not integrate into the new Colburn Street station.

The relief of Andrew Square and Dewar Street stations also addresses an N-1 transmission condition on the K St – Dewar St 115kV lines (483-524/525). The transmission condition is deferred until at least 2010. The relief of Hyde Park Station addresses an N-1 transmission condition on the Baker St – Brighton 115kV line. The transmission condition is deferred until at least 2007.

Alternatives Considered:

Engineering has performed a comprehensive supply study to determine the optimal long-term solution. The study evaluated more than twenty-five options, which consisted of the use of existing substations, expanding existing substations and constructing new substations within the Colburn Street service area. The alternatives considered included:

1. **Use of existing substation capacity and the addition of transfer capability:** This option uses six existing area bulk supply stations, Andrew Square Station 106, Brighton Station 329, Dewar Street Station 483, Hyde Park Station 496, New K Street Station 385 and Watertown Station 467 to meet the capacity needs of the area.

The work plan for this alternative has three major components, transmission work to eliminate the N-1 transmission constraint on 483-524/525 which limits Andrew Square and Dewar Street, distribution upgrades and re-routing in the Brighton area to avoid thermally constrained Harvard Avenue in Allston and distribution capacity upgrades geared toward increasing transfer capabilities between area bulk stations.

An oil return pipe is proposed to eliminate the N-1 transmission constraint at Andrew Square and Dewar. This would allow the use of 35 MVA of existing station firm capacity at Dewar and Andrew Square. In Brighton the re-routing of circuits out of the thermally constrained areas will allow for the use of 12 MVA of existing station firm capacity, 17 MVA of existing transfer capacity. Using the existing station capacity at six bulk stations, Andrew Square, Brighton, Dewar Street, Hyde Park, K Street and Watertown In the Brighton area, 68 MVA of transfer capability can be added at Andrew Square, Brighton, Dewar Street and Hyde Park. To add the new transfer capability significant investment in distribution infrastructure is necessary, 79 circuit miles of new feeder cable. In addition to the new distribution infrastructure there will be station additions are necessary to add line positions at four stations, Brighton, Dewar Street, Hyde Park and Watertown. The proposed new distribution infrastructure allows for higher utilization of the total normal station transformer capacity at Boston area stations.

Station Normal Transformer Capacity– Potential % Utilization

Station	Total Normal Capacity	Potential % Utilization Today	Potential % Utilization After
Andrew Square	178*	73%	96%
Brighton	342	63%	77%
Dewar Street	280	48%	60%
Scotia Street	280	54%	No Change
Hyde Park	280	57.5%	66%

* With new transformer cooling

The average feeder length of the new lines would be greater than 18,000 circuit feet; today the average feeder length is 14,500 circuit feet. This alternative is a

long-term solution. This option does not add transformer capacity at the station level but increases the utilization of existing station capacity through the installation of transfer capability between stations.

2. **Develop 115/14kV Substation on Existing NSTAR Station 284 in Jamaica Plain:** This option will use existing NSTAR 4kV Station 284 on Washington Street in Jamaica. This location is well situated to relieve Hyde Park Station 496 but is over two miles from the primary load center for the Colburn area. The work plan for this option includes the conversion of 4kV load at Station 284 prior to the use of the property for 115/14kV stations. The 4kV conversion work makes this alternative more costly and complex than other options. This alternative is a long-term solution that meets the area distribution and substation capacity requirements.
3. **Develop two smaller 115/14kV Substations on Existing NSTAR Sites:** This option will use the existing NSTAR sites at Station 36 in Allston and PNU 25 in Brookline. The two substations would combine to address the distribution and substation capacity needs for the area. The work plan for this option includes the conversion of 4kV load at both Station 36 and PNU 25 prior to the use of the properties for 115/14kV stations. The 4kV conversion work makes this alternative more costly and complex than other options. This alternative is a long-term solution that meets the area distribution and substation capacity requirements.
4. **Develop a Colburn Street open-air 115/14KV substation on NSTAR land in Roxbury**

The substation and associated distribution infrastructure will be developed to provide expanded distribution and substation capacity to supply the loads within City of Boston neighborhoods of Jamaica Plain, Roxbury/Mission Hill/Longwood Avenue and Kenmore-Fenway and the Brookline Village section of Town of Brookline. The proposed site is located at the epicenter of the load in the area. Because of the close proximity to the load, circuit lengths will be reduced to an average length of 6,300 circuit feet from the existing circuit length of 14,500 circuit feet per circuit. The firm capacity of the new station will be 150 MVA, which supports the relief of five bulk supply substations and the projected load growth within the Colburn Street service area. The station will be designed to accommodate a 4th transformer and a firm capacity of 225 MVA. The initial station development will establish 20 MVA of transfer capability, giving the new Colburn Street station a LCC of 170 MVA. This alternative is part of an integrated long-term solution for the Boston Radial supply area, which will provide the capacity additions needed to meet the new load requirements as well as insure the reliability of service of this area.

The study has determined a Colburn Street open-air 115/14KV substation is the preferred solution.

New East Cambridge Station #875 Substation

Project Description & Objectives:

The initial phase of the proposed East Cambridge Substation project consists of installing sufficient facilities to supply the customers in the Kendall load area in the City of Cambridge. The other two phases of substation expansion will be needed to address the long-term needs of load growth in the East Cambridge area. The new substation will be located in close proximity to both the existing and future customer load centers and to the existing customer feeders located at Kendall Station. Significant load growth has been identified as occurring in this immediate area through developments such as Lyme properties, which is currently under construction. The substation and associated distribution infrastructure will be developed to coincide with the anticipated load growth within the Kendall Square region.

There are several strategic and operational benefits provided by the new East Cambridge substation. This new substation will enable NSTAR Electric to utilize the 115kV system as its transmission backbone for the supply to the 13.8kV distribution system within East Cambridge. At present, NSTAR Electric uses the existing 13.8kV system in Cambridge for both transmission and distribution. Further expansion of the 13.8 kV system as a transmission system has been determined as both infeasible, and uneconomic. Additionally, the removal of generation directly connected to the 13.8 kV system and introduction of new 115kV transmission and substation supply capabilities will significantly reduce the amount of short circuit current available to the 13.8kV system. This has been a growing and significant concern for the design and operation of facilities in the Cambridge system. The new East Cambridge substation will alleviate this concern. See Fig. 1 at the end of this discussion for a simplified one-line that illustrates the existing system.

The proposed new source will completely address both the immediate load growth concerns as well as the loss of generation at Kendall Station.

Scope:

Work planned for 2004

Transmission:

Install one (1) 115kV solid dielectric cable from Putnam to the new substation and terminate at both ends.

Work planned for 2005

Transmission:

Install one (1) 115kV solid dielectric cable from the new substation to the Mirant terminal structure and terminate at both ends.

Re-route one (1) 115kV solid dielectric cable (generator lead) from Mirant terminal structure to the new substation and terminate at substation via MH #7.

Substation:

- Install six (6) 115kV GIS breakers,
- two (2) –115/14kV - 37.5/50/62.5 [70/75] MVA transformer,
- two (2) sections of 14kV distribution switchgear and DSS circuits.

Distribution:

Install distribution 6 circuits to existing circuits into Kendall Station.

Work planned for 2006

Substation:

- Install one (1) –115/14kV - 37.5/50/62.5 [70/75] MVA transformer
- one (1) section of 14kV distribution switchgear relocation of some of the DSS circuits.

Distribution:

Re-route distribution lines to new switchgear, and re-locate Potter Street LCU, if necessary.

The complete proposed bulk substation in East Cambridge #875, (see Fig. 2 at the end of this document,) will be supplied from the 115 kV Transmission system that was built to connect the Kendall Re-powering Project. The additional 115kV solid dielectric cable is being installed into an existing duct system.

Justification:

The existing firm supply capacity in the East Cambridge and Somerville areas is 175MVA. This capacity includes 63 MVA capability at Somerville Station #402, 37 MVA from Putnam Station #831 and 75 MW of generation capacity from Kendall Station #800. The Kendall peak load is expected to be 146 MVA by 2004. The new substation when complete will provide firm capacity of 150 MVA. The area firm will be 249 MVA which is expected to provide sufficient capacity for supplying the area beyond 2013.

MIRANT has modified the design of the existing steam generators at Kendall Station resulting in a requirement that they be dispatched during operation of the new combustion turbine (CT). This design introduces an interdependency that will result in loss of the entire generating source, including the existing steam units for lost of the CT generator. The loss of the 63MW of existing steam generation, as illustrated in the table above will result in a significant reduction in the Kendall region's capacity.

Even with MIRANT maintaining existing generation at 13.8kV (as stated above with a new contract), the impending load growth would require a major investment in a new

source in the system by 2004 - 2005. The forecasted load growth in this area is based on the fact that this vicinity has the last available open space in Cambridge for residential and commercial property development and the city wants it to be developed.

Map of Kendall Supply Area



Table of Kendall load area:

4

Kendall Load Area of East Cambridge: Load Projections/Supply (MVA)

Year	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Projected Load	146	157	164	170	175	179	183	185	187	189
LCC w/o New Resource	119	119	119	119	119	119	119	119	119	119
Load at risk	27	38	45	51	56	60	64	66	68	70
LCC with New Resource	174	249	249	249	249	249	249	249	249	249
Load at risk	0	0	0	0	0	0	0	0	0	0

2004 LCC based on: (with East Cambridge Substation Phase I completed)

99 MVA Firm capacity from Somerville Station #402

75 MVA Firm capacity from new East Cambridge Substation #875

174 MVA

2005 LCC based on: (with East Cambridge Substation Phase II & III completed)

99 MVA Firm capacity from Somerville Station #402

150 MVA Firm capacity from new East Cambridge Substation #875

249 MVA Total

Alternatives Considered:

The initial investigation and analysis considered well in excess of 30 alternatives of which the remaining three acceptable alternatives were evaluated in depth as lowest cost remedies to the East Cambridge/Somerville supply deficiency. They are summarized below:

Alternative # 1 - Recommended Solution – East Cambridge Substation @ Mirant

Build a new 115/13.8kV East Cambridge Substation #875 with the capability of supporting existing loads at Kendall #850, and Prospect #819 at Kendall Station site. The Project would be comprised of the following:

Quantity

2

Description

Transmission lines UG rated at 250MVA at 115kV (one already installed for Mirant's Kendall re-powering)

- | | |
|---|--|
| 1 | GIS with a maximum of 6 breakers, in a ring configuration, to accommodate the 3 lines & 3 transformers. |
| 3 | 13.8kV switchgear sections with a maximum of ten (10) feeder breakers per bus section, a main breaker, and a bus-tie breaker |
| 3 | 115/13.8kV transformers 37.5/50/62.5[70] MVA each with emergency rating at 75MVA each for a total capacity of 210MVA and a firm capacity of 150MVA |
| 1 | Relaying, control, and battery systems |
| 1 | Set of walls with no roof to encompass the above equipment |
| 1 | Distribution work to support existing load at Kendall #850 and Prospect #819 from the new substation |

PROS:

- The supply is close to the load (new and existing).
- The station would use new 115kV infrastructure that has ample capacity. (There is a new 115kV line installed for the Kendall re-powering project and it has spare ducts installed that will be used for another cable to provide a primary and secondary feed to the new substation or equipment in the Mirant yard).
- Provides the fastest placement of resources in the Kendall load area.
- Provides a phased in approach so as not to overly burden the capital budget of the company in any one year.

CONS:

- Real Estate issues:
 - The Kendall site has minor and controllable environmental concerns. Requires relinquishing what has been determined as minimal transmission revenue.
 - Requires the moving of the Potter Street LCU when we release the easement on the property at Third Street.

Alternative # 2– East Cambridge Substation @ 5th Street

Build a new 115/13.8kV East Cambridge Substation #875 with the capability of supporting existing loads at Kendall #850, and Prospect #819 at 5th Street site. The Project would be comprised of the following:

<u>Quantity</u>	<u>Description</u>
2	Transmission lines UG rated at 250MVA at 115kV. One is already installed for Mirant's Kendall re-powering and would extended to 5th Street. One would be installed from Putnam #831 to the new station at 5th Street and a cable would be required from 5th Street to the Kendall generator.
1	Distribution work (longer runs) to support existing load at Kendall #850 and Prospect #819 from the new substation
Rest of equipment is identical to Alternative #1 above.	

PROS:

- The supply is close to the load (new and existing).
- Provides the fastest placement of resources in the Kendall load area.
- Provides a phased in approach so as not to overly burden the capital budget of the company in any one year.
- Would not require the moving of the Potter Street LCU on the property at Third Street.

CONS:

- The 5th Street site has environmental concerns.
- Developer that purchased land would not be required to pay \$2 million to the Company for our relinquishing the easement on the property. There is additional transmission costs associated with this site.
- A filing with the EFSB would be required, due to distance that the lines from Kendall would be extended, and could take up to a year for approval.

Alternative # 3 – Upgrade Prospect Station #819

Upgrade the switching station Prospect Street #819 to a bulk substation by adding 115/13.8kV transformation, and upgrading the existing 13.8kV switchgear would be comprised of the following:

<u>Quantity</u>	<u>Description</u>
1	115kV source of transmission had several options and the best is to tap the existing lines that pass by the station, loop them in and out of the station, and add a radial line from Mystic #250 to the station. This meets the capacity requirement but adds equipment at the station and requires DTE approval and extensive construction (\$6.3 million estimated for increase of 210MVA capacity + \$1.7 million for loop tap). There is one existing spare pipe under the Mystic River, thus filing for a new crossing would not be required for this upgrade. Filing for the street work would be required.
1	GIS with a maximum of 8 breakers to accommodate the lines & transformers
2	115/13.8kV transformers with two (2) secondary windings rated at 37.5/50/62.5MVA each with emergency rating at 70MVA each for a total firm capacity of 140MVA
4	Replace 13.8kV switchgear with upgraded all breakers and busses with customer load off of it
1	Relaying, and control systems
1	Distribution work to supply existing load at Kendall #850 from the new upgraded substation
1	Set of walls to contain the transformers and GIS

PROS:

- Transmission, looping the existing lines in to the station from the street, is less than a mile probably requiring no regulatory approval.

CONS:

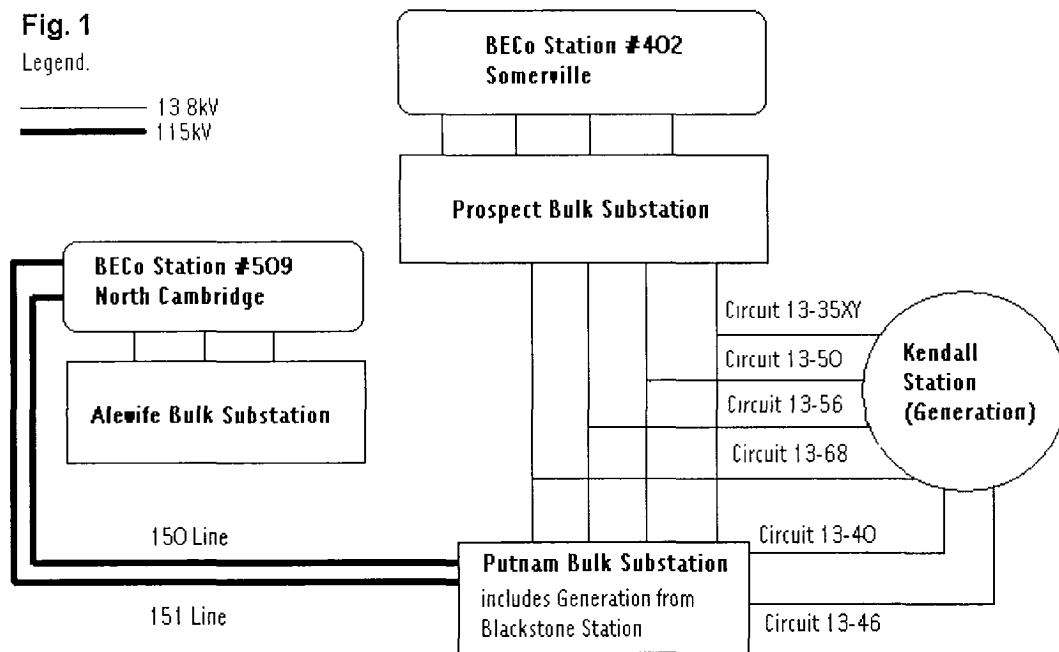
- The supply is not as close to a majority of load (new and existing) as the Recommended Solution.
- The company owns most of the needed Real Estate However, due to the high short circuit current the 115kV breakers and connecting bus are larger and therefore more land is needed to accommodate the breakers. Land adjacent to the Prospect Station is available.
- Requires the moving of the Potter Street LCU when we release the easement on the property at Third Street.
- The 13.8kV switchgear is under rated and needs to be replaced, which will require a construction sequence that will be in terms of months rather than days Customer reliability would be at risk during this time.
- Transmission will need to be upgraded from Mystic #250 since the generation cannot be backed down sufficiently to remove overloads for a loss of line contingency.

Existing System One-Line:

Fig. 1

Legend.

— 13.8kV
 — 115kV



Phase III System One-Line:

Fig. 2

Legend:

— 13.8kV Lines
 — 115kV Lines
 * 13.8kV Breakers
 X 115kV Breakers

